3.

UNITED STATES
DEPARTMENT OF
AGRICULTURE

FOREST SERVICE

GALLATIN
NATIONAL FOREST

BIG TIMBER
RANGER DISTRICT

IMPLEMENTATION PLAN

WESTERN SPRUCE BUDWORM CONTROL

Aerial Application B.t.

IMPLEMENTATION PLAN

WESTERN SPRUCE BUDWORM BT CONTROL PROJECT

Gallatin National Forest
Big Timber Ranger District
Summer, 1987

Approved By: /s/ William E. Timko
William E. Timko
District Ranger

Reviewed By: /s/ Gregory W. Anderson
Gregory W. Anderson
Forest Aviation Officer

Prepared By: /s/ Richard L. Kracht
Richard L. Kracht
Forest Silviculturist/Pesticide Use Coordinator

/s/ Cynthia A. Lackey
Cynthia A. Lackey
District Forester

TABLE OF CONTENTS

INTRODUCTION

The Gallatin National Forest has experienced difficulty in obtaining adequate natural regeneration on cut-over areas within the Douglas-fir (Pseudotsuga menziesii) type. This is due in part to the long periods between good cone crops and the Western Spruce Budworm (Choristoneura occidentalis, Freeman) feeding on foliage and reproductive structures. There is some evidence that the WSBW maintains its endemic population between epidemics within the reproductive structures each year.

On June 2, 1986, an Environmental Assessment, Decision Notice and Finding of No Significant Impact for a WSBW control project was signed by the Forest Supervisor. The alternative chosen involved control of WSBW through the use of Bacillus thuringensis (B.t.) Beliner, a biological agent, over a three year period. The project involves the aerial application of B.t., to approximately 670 acres of the Iron Mountain Timber Sale area. The project was initated in June 1986.

This implementation plan is designed as a guide to ensure a safe and efficient spray project.

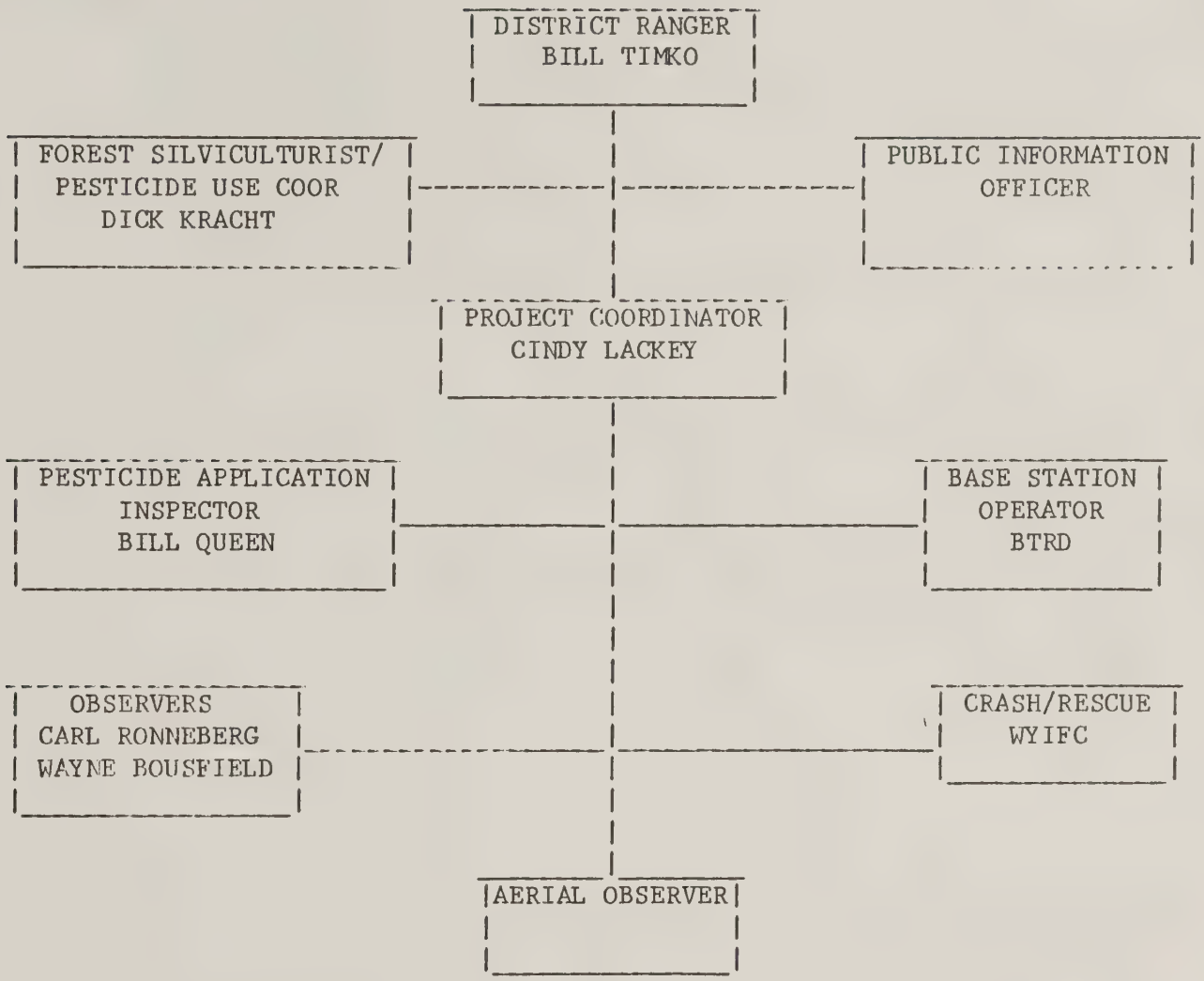
OBJECTIVES

The overall objective for the total project is; established natural regeneration in clearcut harvest units within the sale area.

The objectives for this portion of the project are:

- protection of Douglas-fir foliage, thereby increasing tree vigor
- promotion of the ability of Douglas-fir cone flower development

ORGANIZATIONAL FLOWCHART

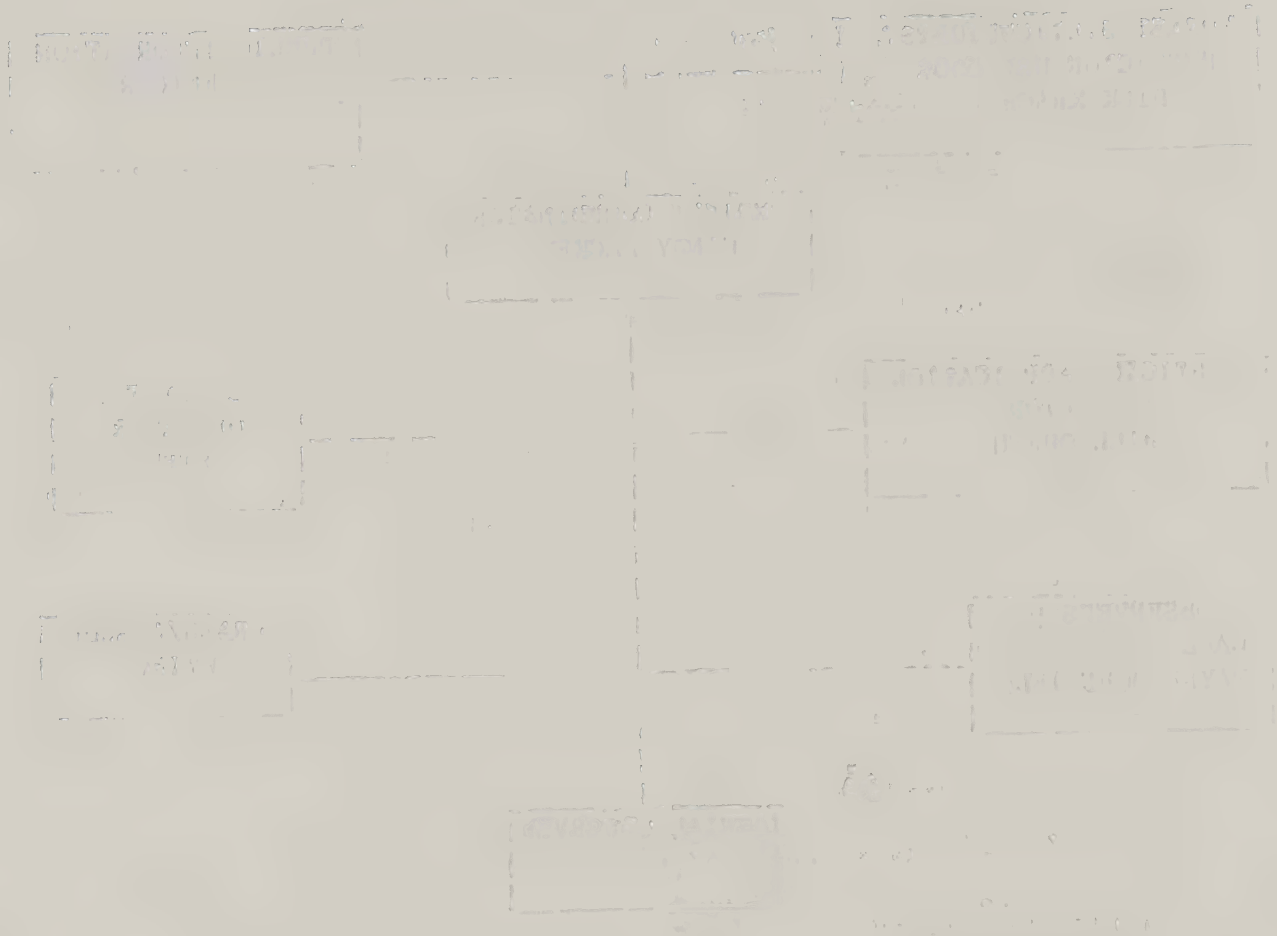


Direct Line of Authority _____
Informational Line ------
(BTRD - Big Timber RD will supply)
((WYIFC - West Yellowstone Interagency Fire Center (Gallatin Dispatch) will supply))

PROJECT FORMULATIONS

Formula:	Thuricide 32-LV	|	Dipel 6AF
Common Name:	BT (Bacillus thuringiensis)	|	BT (Bacillus thuringiensis)
BIU/gal:	32	|	48
BIU/acre:	12	|	12
Diluent:	Water	|	Water

*BIU - Billion International Units



PROJECT APPLICATION

STANDARDS

Rate-of-Application - 1.0 gallon of solution per acre (this gallon of solution contains 12 BIU's of active ingredient).

Droplet Size - 125 - 150 microns

Height Above Canopy - 50 feet

Droplet Density - minimum 20 per square centimeter

CALIBRATION

When an aircraft has been calibrated, the airspeed, spraying pressure, height of flight, and the effective swath width are fixed. Applications must be made at the same settings.

Calibration of a spray system is the adjusting of one or more of several factors so that the proper amount of pesticide is applied per unit of area. In order to calibrate, you must know the following:

a. Rate of application
b. Application speed
c. Swath width
d. Flow rate
e. Nozzle operation

a. Rate of Application

The desired rate of application is; 1.0 gallon of solution per acre

b. Application Speed

The allowable airspeed is determined by the model of spray aircraft being used. After calibration, airspeed for that aircraft remains fixed for field application.

c. Swath Width

Swath width will be determined by the effective amount of pesticide distributed evenly on spray deposit cards with a minimum of 20 drops per square centimeter.

d. Spray Pressure

The spray pressure and flow rate for calibration is dependent on the type of nozzle used, as well as speed. The allowable range in operating spray pressure at the boom will be +5 p.s.i. The calibrated boom pressure will remain constant for application.

Calibration Calculation

An aircraft spray system can be calibrated on the ground or in the air using the following formula:

$$\text{Acres per minute} = \frac{2 \times \text{Swath Width} \times \text{Miles per Hour}}{1000}$$

When: Swath width equals the simulated adequate application width for the given aircraft and its spray configuration.

Example: Determine the acres per minute for an aircraft flying 50 MPH with a 100 foot effective swath.

$$\frac{2 \times 100 \times 50}{1000} = 10 \text{ acres per minute}$$

If a gallon of spray is to be applied per acre, the flow rate should be calibrated to disperse liquid at the rate of 1 x 10 or 10 gallons per minute (flow rate).

Knowing the gallons per minute required, the number of nozzles can be calculated using the manufacturer's data for that type and pressure. If 8010 flat atomizing teejet nozzles are used at 40 p.s.i., the discharge rate is 1.0 gallon of liquid at 70 degrees F per minute per nozzle.

$$\#\text{ of Nozzles required} = \frac{\text{Flow Rate G.P.M.}}{\text{Nozzle Discharge 1 minute at p.s.i.}}$$

$$= \frac{10}{1.0} = 10 \text{ Nozzles}$$

Discharge Calibration

Having installed the desired type, size and number of nozzles, the output of the system should be checked to see that the correct discharge in gallons per minute is taking place. If the pump can be run at operating speed with the aircraft stationary, nozzle discharge can be checked with a measuring container and a stop watch.

Boom pressure must remain constant. If the stationary test cannot be done, then the spray tanks should be filled with water or fuel oil to a known mark. The aircraft then flies for a given length of time and is brought back to the same position as before and the amount of water or fuel oil used is determined by reading the tank scale, or refilling to the original mark with a measuring device.

Adjusting Calibration

1. If the flow rate is more than calculated:

    a. Check nozzles for oversize orifices, replace if necessary, and repeat calibration proceedure; or

b. Adjust boom pressure, if it was too high, and repeat calibration proceedure; or

2. If the discharge volume is less than calculated:

a. Clean nozzles, and repeat calibration proceedure; or

b. Adjust boom pressure, if it was too low, and repeat calibration proceedure; or

c. Add sufficient nozzles to bring application time within the allowable range, and repeat calibration proceedure; or

d. Increase orifice size

3. Proper calibration should normally be obtained in three or less attempts. If more than three trials are required and results are erratic, the following possibilities should be investigated:

a. Aircraft pump defective; or

b. Dirt or other foreign material present in spray system, or in calibration solution; or

c. Stop watch defective; or

d. Incorrect reading of measuring devices or error in computations.

Checking Calibration in Air

The spray system calibration should be checked in the air as soon as posible after obtaining acceptable ground calibration, and daily thereafter. This can be accomplished by using a stop watch to determine the time it takes to spray out a known quantity of spray.

Example: Desired Flow Rate = 10 GPM

Gallons in Load = 80 Gallons

Desired Application Time = $\frac{80}{10}$ = 8 minutes

Actual Time to Spray = 8 minutes 10 seconds
(Allow +/- 5% from desired time)

Observers will check the calibration of each assigned spray aircraft daily. Records of the time required to spray out a known load quantity will be maintained.

Swath Pattern Tests

With the application rate now established, the swath pattern should be checked to see that the distribution across the swath is as uniform as possible.

The best method of spray pattern testing consists of adding a tracer (dye, fluoescent material, etc.) to water or fuel oil in the tank(s) of the aircraft. The aircraft is then flown at the appropriate airspeed and height and the spraying system is operated at the appropriated pressure. One pass is made over a row of target plates or cards laid out a right angles to the direction of flight. The aircraft flies over the center of a target line, 300 to 500 feet wide. A pass should be made upwind and another crosswind. Wind speed should be as low as possible. The targets are collected and the spray deposit on each target is measured by the quantity of tracer. From the results, the distributioin curve of the pattern can be determined. Corrections to the nozzle location can be made and the results checked by further testing.

A less satisfactory method is to lay out a roll of paper tape (adding machine tape) and visually inspecting the resultant pattern. Interpretation of the spray pattern using this method is at best, only a rough estimate of the uniformity of the deposit pattern.

Checking Flight Speed

The application speed of the spray aircraft should be frequently checked, using the following proceedure.

Ground Observer

1. Time the interval that a spraying aircraft takes to cover a known distance. Use a stop watch to the nearest second.

2. Measure the distance of the flight line between the two known points on an accurate map or photo to the nearest foot.

3. Calculate the application speed using the following formula:

$$\text{MPH} = \frac{\text{Distance in Feet}}{\text{Time in Seconds} \times 1.47}$$

Example: A spraying aircraft covered a measured flight distance of 3,300 feet in 44 seconds. The flight speed is:

$$\frac{3{,}300 \text{ Feet}}{44 \times 1.47} = 51 \text{ MPH}$$

OR

4. Use a radar gun.

[illegible]

[illegible]: Flight [illegible]

The [illegible] relation depends [illegible] using the following procedure:

Ground Checker [illegible]

1. Time the [illegible] flight [illegible] distance. Use a stop watch [illegible].

2. Measure the distance of the flight line [illegible] points on a [illegible] map [illegible].

Calculate the application [illegible] using the following formulas:

Distance in feet [illegible] / Time in Second [illegible] 1.47

[illegible]

Aerial Observer

1. Pace with an observation aircraft

2. Use the observation aircraft airspeed indicator. Use the formula above to determine the accuracy and/or to establish a correction factor.

OR

3. Use a radar gun.

The application speed should be within +/- 5% of the calibrated speed. If the application speed is outside of the allowable range, request the pilot to correct his flying speed.

Characterization

This is the evaluation of the spray droplet size. The specified droplet size for this project is; 125 - 150 microns.

Use the following proceedure:

a. Calibrate the aircraft as to flow rate and swath width.

b. Layout spray cards at intervals of 10 feet perpendicular to wind direction (300 - 500 feet long).

c. Mark centerline and start smoke bomb.

d. Aircraft flys into wind across card line, speed is measured.

e. After 5 minutes, the cards are picked up and read using D-Max method.

SPRAY STANDARDS

The following standards are to be used to determine when spraying operations should be suspended. Any variations of these standards, both more or less stringent, must be approved by the Project Coordinator.

Standards

While it is important to the overall success of the Project that the Application Team follow the standards of when to or not to spray, remember that many of these standards will require Professional Judgement before a decision can be made. The goal of these standards is that the same criteria is being used by everyone making the Go or No-Go decision.

I. Weather

Moisture, wind, humidity, air temparature, and ground temparature are all important factors that affect spray drift and the upward rising of spray droplets.

A. Wind

Maximum allowable wind speed is six (6 MPH). No spraying should be attempted or all spraying should cease if wind speeds are in excess of this within the spray block.

If the application aircraft pilot is unable to compensate for spray drift caused by increasing wind speeds or if wind speeds will cause drift into Off-Target areas, spraying should stop.

B. Moisture

1. Fog

No spraying should occur when fog or low clouds cover the area to be sprayed.

2. Dew

Spraying may occur when foliage is damp or wet as long as the foliage is not dripping. This condition could exist in early mornings.

3. Rain

No spraying will take place if it is raining or if rain is forecasted within twelve (12) hours of the spray application. If it has rained previous to the start of the spray application and the foliage is not dripping, spraying can proceed.

C. Humidity

No spraying will occur if the humidity within the spray block falls below fifty (50) percent. Conditions may exist that will cause a rapid decrease in the humidity in a very short time span. If this occurs, and it is detected that the spray droplets are not getting to the ground, cease spraying until the condition stabilizes. If, after stabilization, the humidity is above 50%, spraying may resume.

D. Temperature

All spraying will stop when the air temparature at application altitude reaches seventy (70) degrees F. Application altitude is the temparature at the altitude of the application aircraft.

[illegible]

[illegible] wind speed [illegible] (4 MPH). No spraying should [illegible] [illegible] spraying should [illegible] [illegible] of drift within the [illegible].

If the application [illegible] [illegible] caused by [illegible] will cause drift into off-target [illegible].

C. Metaldehyde

1. Fog

a. Spraying should [illegible] fog [illegible]
[illegible]

2. Dew

[illegible]
[illegible]
[illegible] morning.

3. [illegible]

[illegible]
[illegible]
[illegible]
[illegible] spraying
and [illegible].

[illegible]

[illegible] humidity [illegible]
[illegible] percent. [illegible]
[illegible] the humidity [illegible] very [illegible]
[illegible] It is [illegible] that the spray droplets
the ground, [illegible] the condition
for stabilization, the humidity is above 50%.

[illegible]

If the application altitude temparature is warmer than the surface temparature (even if it is below 70 degrees), the spray will begin to "hang". From the side, the spray will have a "camel back" appearence. Spraying should stop if this condition exists.

If the surface temparature rises faster than the application altitude temparature, an updraft will occur, causing the spray to rise. This could be evident on southern exposures and dark terrain features early in the morning. If this condition exists, stop spraying in this area and, if possible, move to another portion of the spray block.

Inversions - An inversion is where cool air is trapped at the surface by a layer of warmer air. It is not a problem if the application aircraft can work in the area of cooler air. If the application aircraft can not work in this lower area, the spray will not be able to penetrate the cooler air mass and will hang and drift off target. Suspend spraying if this condition exists but continue to monitor surface and application altitude temparatures. Inversions have a habit of breaking down rapidly which may present an opportunity to continue spraying.

II. Irregular Spray

A. Spray Droplets

1. Droplet Size - The specified droplet size is approximately 125 - 150 microns. If they are too small or too large, a problem exists and spraying should stop until it is corrected.

2. Droplet Dispersal - The goal is to get 20 drops per square centimeter. Weather conditions will usually be the cause of too few drops, or a mechanical problem with the application aircraft (like a clogged nozzle). Stop spraying if this condition exists.

B. Condition of B.t

Improperly mixed B.t. will have a great impact on the type of spray received. If it is suspected that the B.t. being used is contaminated in any way, suspend the use of that batch.

III. Mechanical Conditions

A. Aircraft

Suspend spraying activities if any of the following conditions exist:

1. Mechanical problems.

[illegible] is [illegible]
[illegible] (see Figure 6). [illegible]
[illegible] through the [illegible] from the [illegible]
[illegible] [illegible] condition
[illegible].

If the ambient temperature rises [illegible] the [illegible] [illegible] [illegible] [illegible] [illegible]
[illegible] [illegible] [illegible] in the morning. [illegible]
[illegible] in this area and, if possible, [illegible]
[illegible] block.

Investigations [illegible] large [illegible] water [illegible]. It is [illegible]
[illegible] in the [illegible]
[illegible] will not be able to [illegible] will [illegible]
[illegible] larvae. [illegible] of this condition [illegible]
[illegible] continue [illegible] [illegible]
[illegible] investigations have [illegible]
which [illegible]

[illegible]

7. Typey [illegible]

1. Triplet [illegible] - The [illegible] [illegible]
[illegible] they [illegible]
[illegible] and [illegible] until [illegible]
[illegible].

2. [illegible] - The [illegible] [illegible]
[illegible]. Weather conditions will [illegible] the [illegible] of
[illegible] with the [illegible]
[illegible] operating [illegible]
[illegible]

Conclusion [illegible]

Incorrectly [illegible] have [illegible] to the type of
[illegible]. [illegible] is [illegible] as
[illegible] the use [illegible].

2. Poor operating spray system

   a. Plugged nozzles

   b. Leaking system

   c. Non-operating quick dump

   d. Non-functioning meters and/or gauges

3. Communications problems

B. Batch Trucks

If there is only one batch truck present, suspend spraying activities if any of the following conditions exist:

1. No batch

2. No operator

3. Non-functioning meters

4. Leaking system

5. Non-operating pump

C. Personnel

Suspend spraying activities if the following personnel are not present or are non-functional:

1. Application pilot

2. Observers

3. Pesticide application inspector

PRE-SPRAY CHECKLIST

NOTIFICATIONS

JOB	TIME	ACCOMPLISHED
A. Notification of residents of intent to spray.	Spray project is entirely within and surrounded by National Forest lands. No private landowners are within one mile of the project. Notification will be given to Big Timber area through news release several weeks prior to spraying.	
B. Check equipment: 1. Operations 2. Monitoring	2 weeks prior to spraying.	
C. Meet with timber sale contractor & explain project & impacts on traffic, logging, etc.	late May - early June	
D. Review contract. Review area for potential problems.	2 weeks prior to spraying.	Approx. June
E. Organizational meeting	1 week prior to spraying.	Approx. June
F. Check & load equipment: 1. Operations 2. Monitoring	1 week prior to spraying.	
G. Contact logging contractor & confirm spray date & time.	2 days prior to spraying.	
H. Pre work with contractor	Prior to start of project.	
I. Notify FAA Flight Service	1 day prior to spraying & at completion of spraying	
J. Notify Forest Aviation Officer (through WYIFC)	Day of flight & at completion of flight	
H. Notify Gallatin Dispatch	1 day prior to spraying & at completion of spraying	

VEHICLE ASSIGNMENTS

SPRAY TEAM:

Wayne Bosfield.....will bring from RO
Cindy Lackey.....3153
Carl Ronneberg.....7394
**Bill Queen.....will bring from D6

RADIO NEEDS

Person or Location	Type of Radio	#Required
C.O.R./Project Coordinator (Cindy Lackey)	Portable	1
Pesticide Application Inspector (Bill Queen)	Portable	1
Observers (Carl Ronneberg)	Portable	1
(Wayne Bosfield)	May be in observation plane	1
Dispatcher (Big Timber)	Repeater	1
Dispatcher (West)	Repeater	1
Observation Aircraft	VHF-AM (720)	1
	VHF-FM (9600)	1
Spray Aircraft	VHF-AM	1

MANPOWER PLANNING

JOB	NAME	EXPERIENCE	TRAINING NEEDS
C.O.R.	Cindy Lackey		
Pesticide Application Inspector	Bill Queen	certified applicator	
Observer	Wayne Bosfield		
Observer/Road Closure	Carl Ronneberg		

ROAD CLOSURES

The entire project area has only one primary access route, Iron Mountain Rd., Road #482, making closure fairly easy.

One person with a road closed sign will be stationed just outside the treatment area to stop traffic. This traffic control person should position himself far enough away from the boundary of the treatment area to avoid any possible spray drift. If you are approached by a vehicle, explain what we are doing and that they will have to wait until we complete spraying the site. Estimated spray time is 3 hours. Should there be any difficulty with a person adamant about going through, contact the C.O.R. on the radio.

There is currently an active timber sale in the area. Arrangements will be made with the contractor on hauling and impacts of the spray project on logging, should there be an imperative need to allow log trucks to continue hauling, then they will be allowed to pass at intervals during which the plane is refueling.

ORGANIZATIONAL MEETING AND INFORMATION

An organizational meeting will be held to acquaint everyone with the project. An overview of the entire project should be given so that everyone has a basic concept of what the project is all about.

Specific emphasis will be given to cover the duties of each job, the lines of authority, and the responsibilities of each individual.

Contractor Briefing

A briefing will be held with the contractor at which all individuals associated with the project should be present if possible. The contractor shall be briefed on the duties of each individual. The contract shall be carefully reviewed with the contractor, making sure all contract specs are covered. This will occur the morning of or at some time prior to spraying.

Job Descriptions

A. COR/Project Coordinator

Is directly responsible to the Contracting Officer and appropriate line officers for a safe, effective, and efficient administration of the project.

Duties:

1. In charge of planning and assignment of duties and responsibilities.

2. Responsible for all project operations.

[illegible] -- [illegible] Center [illegible]
[illegible].

[illegible] will [illegible] [illegible] -- This [illegible] [illegible] should [illegible] [illegible]. This the [illegible] 12 [illegible] [illegible] [illegible] [illegible] will [illegible] until we [illegible] [illegible] time to [illegible]. Should there be any [illegible] with a [illegible] [illegible], contact the [illegible] [illegible].

[illegible] [illegible] [illegible] [illegible] [illegible] [illegible] they should [illegible] [illegible] [illegible], then they will be all set to go. [illegible] [illegible].

ORGANIZATIONAL MEETING -- [illegible]

An organizational meeting will be held [illegible] [illegible] the meeting [illegible] [illegible] [illegible] [illegible] what the [illegible] is all about.

Specific [illegible] will be given [illegible] [illegible] [illegible] [illegible] [illegible] and the [illegible] [illegible].

[illegible] [illegible]

A [illegible] will be held [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] individuals [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] will occur [illegible] [illegible] [illegible] [illegible].

[illegible] [illegible] [illegible] [illegible]
[illegible] [illegible] [illegible]

3. Provide instruction and training to project personnel on individual work responsibilities of the total operation.

4. Monitor all areas of project for safety.

5. Assure that the Base Station Operator and Public Information Officer are prepared for the application day. Responsible to critique the work of the day, identify logistical problems and develop means of improving coordination within projects.

6. Foster cooperation and understanding between the contractor and project personnel.

7. With the assistance of the contractor and inspectors, observe the application of pesticide formulations.

8. Observe the pilot's practices, height of flight, air speed, and flight pattern. Work through contractor's representatives to correct poor or unsafe practices.

9. Coordinate resources as necessary in the event of a spill or accident.

10. At the end of the day brief the contractor's representative on the following day's work plan.

11. Maintain contact with Pesticide Application Inspector or Observers, as applicable, concerning weather, safe flying and application procedures.

12. Keep Contracting Officer and Project Coordinator, if separate, informed of progress and of potential and current contractual problems.

13. Ensure that pilot has the proper maps and photos, is familiar with the treatment areas, and has the correct formulation and gallonage for each area.

14. Maintain accurate records of plane takeoffs and landings. Report to Base Station when beginning and completing all treatment areas.

15. Contact adjacent landowners and water users as shown in Public Contact Plan.

16. Talk with interested parties during the project. (District Ranger to handle)

17. Write news releases and keep the public informed on progress of the project as necessary.

18. Will be responsible for and conduct show-me trips to project sites as deemed appropriate.

B. Pesticide Application Inspector

Duties:

Used where the COR is not on site and normally is stationed at the landing site. The P.A. Inspector has the responsibilities of an inspector in addition to the following:

1. Maintain accurate records of plane takeoffs and landings. Report to Base Station when beginning and completing all treatment areas.

2. Works with the contractor's personnel to plan day by day operations.

3. In the absence of the COR has the authority to:

   a. Suspend operations when safety requirements are being violated, faulty equipment is being used, or when application is not being done as prescribed by the contract.

   b. Inform contractor's representative when suitable application conditions exist or do not exist.

   c. Periodically check calibration of application system.

   d. The P.A. will be directly involved in the batching process, making sure that the contractor's representative is following the contract and label directions.

C. Observer (Ground and Aerial)

Specific duties may vary to meet the requirements of the individual situation.

Duties:

1. Maintains radio contact with the pilot during application on the unit.

2. Maintains records and all weather data (winds, temperature and humidity), is responsible for relaying the data to the COR prior to application and keeping the COR informed of any significant changes during application.

3. Notifies the COR when leaks or drooling nozzles are observed.

4. Informs COR that application should be stopped in unit if weather conditions are not in compliance with all applicable State and Federal laws and label instructions.

5. Must be familiar with every unit assigned and aware of all hazards and sensitive areas. Must inform the pilot of these areas if and when it is necessary.

6. Observes application procedures, flying height and speed, swath width, and overall formulation distribution.

7. Posts treatment area signs (Forest Service Form P2-2) as required by the current Environmental Assessment.

8. Must be familiar with search and rescue plans and be prepared to handle emergencies accordingly.

D. Base Station Operator

The Base Station Operator is responsible for coordinating all field needs of individuals involved with the project. Should be familiar with radio operations and assigned specifically to the project.

Duties:

1. Maintains communication with project personnel.

2. Must be familiar with the Safety Plan and the Spill Plan. The Base Station Operator must know who to contact and be able to mobilize the personnel and equipment necessary in the case of an emergency.

3. Responsible for individual notification as indicated in the Public Contact Plan.

E. Public Information Officer

The Public Information Officer is responsible for disseminating information on the project to the public as addressed in the Forest Environmental Assessment.

PUBLIC CONTACT PLAN

In addition to the Regional and Forest level public information efforts, the following contacts should be made with public, private, and other Government parties.

1. Review the proposed project with State Department of Fish and Wildlife personnel.

2. Ensure copies of the Environmental Assessment are available for review at the Ranger Station and Supervisor's office.

3. Notification of pesticide treatment will be made to the following if warranted:

   a. Adjacent property owners.

   b. Range allotment permittees whose range allotments are affected by treatment.

c. All other people, such as loggers, prospectors, contractors, and Force Account crews that may be camping or working near the project areas at the time of treatment, will be notified.

4. All inquiries concerning the project should be directed to one of the following: District Ranger, Forest Silviculturist, Forest Pesticide Use Coordinator or Public Information Officer.

5. A news release will be made to the Big Timber media immediately following award of the contract. The release will give the estimated start work date. Field trips for the press will be conducted by District Ranger if requested.

6. Public Information Office and SO receptionist will receive copy of news release and will be updated as to project status and spray dates.

MONITORING

Suppression of the western spruce budworm with the non-persistent insecticide Bacillus thuringiensis (B.t.) requires careful timing of the application to coincide with the appropriate developmental stage of the insect. Development of budworm through the juvenile stages progresses quite rapidly. During the third through fifth-instars, budworm larvae feed openly on foliage as it unfurls and shoots elongate. Application of the insecticide during this stage of host phenology insures the availability of sufficient needle surface area upon which the insecticide can be impinge. Since pathogenicity of B.t. requires that a letal dose be consumed by larvae, we are targeting the development stage that will consume enough treated foliage to produce mortality -- 60% of larvae in fouth or fifth instar.

The pace at which the budworm advances is enhanced by favorable weather. Warm, dry weather, and especially warm nights, promote budworm feeding and increase metabolic processes that translates to a rapid rate of development. The period of time between instars may be only 3 - 4 days under these conditions, hence, timing of application is critical.

The optimum conditions for treatment, result in a fairly narrow Effective Spray Interval 1/. Treating too early could result in many individuals escaping exposure to B.t. because of feeding unexposed in swollen buds, or that the activity of B.t. is diminished by exposure to ultraviolet radiation from sunlight before being ingested by larvae. Spraying too late might result in avoidance of B.t. by those individuals which have advanced into the late sixth-instar and have ceased feeding prior to pupation.

1/ Effective Spray Interval - that interval, expressed in days, during which an insect is in a stage of development determined to be optimal for producing an insecticide-caused mortality by application of a given dosage of a specific chemical or biological agent; independent of weather or any other factor that might affect application.

[illegible] be [illegible] by [illegible] the project [illegible] will be notified.

[illegible] the project [illegible] directed [illegible] District Ranger, [illegible] Public Information [illegible]

5. A news release will be made to the Big Horn [illegible] of the contract. The [illegible] Field trips for the press will be [illegible] District [illegible] requested.

6. Public Information Office and [illegible] will [illegible]

[illegible]

[illegible] of the [illegible] in [illegible] [illegible] [illegible] Development [illegible] the third [illegible] [illegible] the [illegible] [illegible] people [illegible] of [illegible] feeding to produce mortality [illegible] [illegible]

The [illegible] weather, and [illegible] are [illegible] [illegible] the [illegible] [illegible] [illegible] [illegible] days [illegible] [illegible]

[illegible] could result in many [illegible] [illegible] [illegible] by [illegible] to ultraviolet [illegible] by [illegible] Spraying too [illegible] [illegible] [illegible] [illegible] [illegible]

[illegible] and in days, during [illegible] to be optimal for [illegible] of a given dosage [illegible] [illegible]

Even with the best timing of spray applications, some of individuals will escape mortality due to the range of instars represented, and differing host phenologies (as influenced by site, elevation, and other factors) over the spray block, at the time of application. In considering these factors, this Monitoring section has been designed with various standards which will: 1) insure that only those areas benefitting from treatment are treated; 2) insure that the timing of insecticide application is optimized over most of the spray block; and 3) achieve budworm population reductions which meet or exceed objectives for the Project.

This Monitoring section will require a number of different types of sampling strategies to be used to assess populations, timeing of insecticide applications, assess treatment application, and assess treatment effects. Each type of sampling will occur during specific phases of the Project.

EARLY LARVAL DENSITY SAMPLING

Objectives

Population sampling will be used early during insect development to estimate population densities for the purpose of qualifying for treatment. This sampling strategy will determine the need for treatment.

Qualifying Standard *

Timing

May 1987

Sampling Plan and Procedure *

* to be done by RO-CFPM

LARVEL DEVELOPMENT SAMPLING

Objective

The efficacy of B.t. treatment depends upon applying the correct dosage at the proper time. This sampling is to determine when to apply B.t. so that the probability of larval mortality will be greatest. The spray block will be "released" for treatment when development sampling indicates that the budworm has obtained the optimal stage for treatment with B.t.

Release Standard *

Timing

Mid-June 1987

Sampling Plan and Procedure *

*to be done by RO-CFPM

POST-TREATMENT BUDWORM DENSITY SAMPLING

Objective

The purpose of this sample is to evaluate the short-term success of the B.t. application in reducing populations of western spruce budworm to an acceptable level or below. Sampling will determine the post-treatment residual population levels for comparison against the target levels.

Population Reduction Standard *

Timing *

Sampling Plan and Procedure *

*to be done by RO-CFPM

POST-TREATMENT DEFOLIATION ESTIMATES

Objective

Post-treatment defoliation will be estimated to establish a baseline defoliation level with which to compare following years of defoliation against, as a measure of long-term effectiveness of B.t. treatment.

Timing *

Sampling Plan and Procedure *

* to be done by RO-CFPM

WEATHER OBSERVATIONS

Objective

The purpose of these observations is to determine that the appropriate weather conditions are present in the treatment area; prior to, during, and following the spray application.

Timing

Weather parameters/forecasts of temperature, relative humidity, precipitation, wind speed and direction will be recorded/monitored starting approximately one week prior to spray application, and continuing approximately one week following the spray application.

Sampling Plan and Procedure

The weather parameters will be recorded continuously with a "Climatronics" remote weather station and/or a hydrothermograph throughout the duration of the project.

General "Fire Weather" forecasts from the Billings or Missoula Fire Weather Service will be used to indicate weather patterns over the project area. These will be reviewed by the Project Coordinator daily.

Project specific "Spot Weather" forecasts will be used in scheduling the actual spray application. This forecast will be requested from the Billings Fire Weather Service through the District Office or Gallatin Dispatch (WYIFC). Prior to the day that the actual "Spot Forecast" is requested, the Project Coordinator shall have informed the Billings Fire Weather Service of the project (location, maps, etc.) so that they can provide an accurate forecast. On the day that the forecast is requested (probably one day prior to application), the Project Coordinator will provide the Billings Fire Weather Service with that days weather readings plus the previous several days weather readings from the information recorded by the remote weather station.

AERIAL OBSERVATION

Objective

The purpose of this observation is to insure that the spray application is confined to the treatment area, i.e., the pilot stays within the treatment unit boundaries when spraying and that the spray cloud settles into the trees inside the treatment unit, and the spray aircraft is operating correctly.

Timing

An observation aircraft, with a project Aerial Observer, will circle the treatment area anytime that a spray aircraft is in the air over the treatment area.

Sampling Plan and Procedure

The Aerial Observer will visually check the spray aircraft location, speed, and operation while it is applying spray to the treatment area. If any discrepencies are noticed the Aerial Observer will immediately notify the Project Coordinator, who will take immediate steps to correct the situation.

[illegible] recorded [illegible] was [illegible] spray [illegible] weather [illegible] a [illegible] the project.

General [illegible] weather forecasts from the Billings [illegible] forecasts, [illegible] These will be received by the Project [illegible]

[illegible] "Go/No-Go" forecast will be used [illegible] the actual spray application. [illegible] Billings [illegible] (Billings [illegible]). [illegible] the Billings [illegible] Weather Service [illegible] that day [illegible] the forecast is requested (probably [illegible]) [illegible] Billings. [illegible] that says weather conditions [illegible]

SPRAY [illegible]

Objective

The purpose of this [illegible] application is confined to the [illegible] within the [illegible] spray [illegible] into the areas inside the treatment unit, and the spray aircraft is operating correctly.

[illegible]

[illegible], with a project Aerial Observer [illegible] that a spray aircraft is in the air [illegible]

1. check the spray aircraft [illegible] is [illegible] up [illegible] to the [illegible] [illegible] of the [illegible] observer will [illegible] instructor, who will take immediate [illegible]

SPRAY CARD ASSESSMENT

Objective

The purpose of the spray card assessment is to determine the overall quality of the spray application over the treated area. Analysis of spray deposit data will 1) determine if the treatment is reaching the intended target area; 2) determine if the treatment coverage was uniform over the treated area; and 3) determine whether the contractor met the minimum acceptable application density (20 drops per square centimeter on randomly placed droplet deposit sampler lines), and the acceptable droplet size (125 -150 microns) as specified in the contract.

Timing

Spray deposit cards will be put out in predetermined locations just prior to spraying the block. This will require crews to be at the deposit sampling plots in time to place deposit samplers (spray deposit cards) at the sampling plots prior to the aerial application. Typically, the card crew will be on the deposit sampling plots well before daylight, since treatment may begin 1/2 hour before sunrise. Cards should not be placed in the field overnight, because dew can cause the cards to warp which might result in a non-representative sample of deposit, and make drop counting more difficult.

Sampling Plan and Procedure

An attempt will be made to obtain spray deposit information from representative areas in the treatment area.

The sampling design will make use of an equilateral triangle sampling grid, similar to that used for characterizing aircraft spray (Dumbauld and Rafferty, 1977). If a triangular sampling grid cannot be established because of space limitations, a meandering line will suffice. Spray deposit will be assessed by a minimum of two triangular spray sampling grids or cardlines randomly placed in openings suitable for sampling. Additional deposit sampling grids can be put out if time permits. Each leg of the triangle will be 450 ft long, and will contain 15 deposit samplers spaced at 30 ft intervals on each of the three legs of the triangle. The triangle sampling grid geometery is designed to minimize the angle between the flight path of the aircraft and the sampling line, since it may not be known before hand, the direction in which the flight will occur. Cardlines which cut across a spray block may be used when the direction of flight is known. In these cases, more than 45 cards may be used. Also it may be desirable to increase the distance between sample cards.

Sampling site selection should be done ahead of time so that the crew may become familiar with the terrain where samplers will be located. Potential hazards along the route to the sampling site should be removed or marked well enough so that they can be recognized and avoided by card assessment crews that must enter the sites in the dark, early morning hours to put out spray deposit samplers. The

The amount of the spray ... [illegible] ... quality of ... spray ... [illegible] ... spray deposit ... [illegible] ... distribution ... [illegible]

[illegible]

Spray deposit cards will ... [illegible] ... prior to spraying ... [illegible] ... deposit ... [illegible] ... deposit cards ... [illegible]

Sampling ... Procedure

An attempt will be made to ... spray deposit ... [illegible] ... from ... in the forests ... [illegible]

The sampling design will ... [illegible] ... and ... [illegible] ... will be ... [illegible] ... each sampling ... additional ... [illegible]

... more ... [illegible]

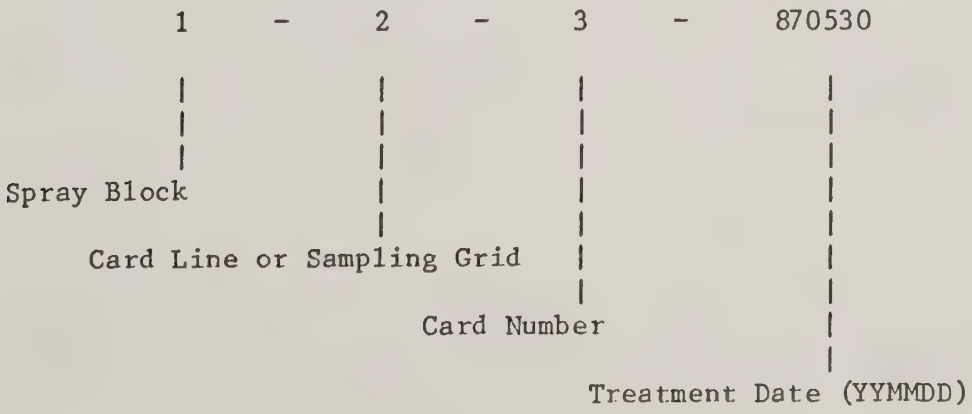
[illegible]

sampling sites should be relatively large open areas, which are free of obstructions that would interfere with the placement of samplers or ability of the samplers to intercept the spray deposit. Brush or tall grass should be cut or trampled down around deposit samplers, if the height would hinder droplets in reaching spray cards.

On the day before the area is to be sprayed, wire cardholder stakes are positioned in the field into the triangular configuration to form the sampling grid. The wire cardholder is designed with a knot at the top for holding spray deposit cards above the ground to prevent damage from ground moisture, animal damage, and other factors (Maksymiuk, 1959). Lengths of ribbon knotted together can be attached to each wire stake to aid in locating the sampling grid during early morning hours of the spray day.

Spray deposit cards are marked in advance to identify them. A plastic template with a small square (1 square centimeter + pencil lead width) cutout will be used to draw a counting square on one side of each deposit card in advance of using the cards in the sampling grid. Only droplets within the pre-established square on each card will be estimated and/or counted. The square drawn on the card before spraying pre-selects a random deposit area for counting and thereby reduces the chance of bias in selecting the sampling area on the deposit card.

The importance of accurately marking spray cards cannot be overemphasized. Spray deposit data can be lost if care has not been taken to properly and systematically label and number spray cards. Kromekote-coated cards with white on both sides will be used as deposit samplers. An identification coding system will be used to mark spray deposit cards. Crews will use the following simple marking instructions to label the cards, using a water insoluble felt-tip pen (Sharpie).



The cards should be marked at the bottom, with 1/4 inch-high numbers. After marking, each card is placed into a yellow or orange plastic cardholder with the deposit surface up, and the cardholder with card is slipped between the loops of the special wire stakes which were placed in the field the previous day.

and be relatively large open areas [illegible]
ies would interfere with the placement of [illegible]
danger to intercept the spray deposit [illegible]
trapped droplets could [illegible]
c. have an absorbing spray card

On the day before the area is to be sprayed, wire card [illegible] in the field into the triangular configuration [illegible] the sampling grid. The wire card [illegible] is designed with [illegible] for the spray deposit [illegible] from ground contamination. [illegible] Lengths of rubber [illegible] with stake [illegible] in lopping the sampling [illegible] out [illegible] the spray day.

Spray deposit [illegible] are method [illegible] advantages [illegible] (spray [illegible] emulsions) [illegible] card [illegible] of using [illegible] Only [illegible] the pre-established [illegible] The square drawn [illegible] card. Before [illegible] pre-selected random deposit area for counting [illegible] selecting the sampling [illegible] deposit cards.

The [illegible] of [illegible] mostly [illegible] spray [illegible] Spray deposit [illegible] then carefully and systematically [illegible] cards [illegible] rated [illegible] with [illegible] on both [illegible] sampling [illegible] deposit cards [illegible] instructions for laboratory [illegible] cards, using a [illegible] (Appendix).

Placement of card grids or lines is critical to the collection of useful and accurate spray deposit information. Large openings should be utilized where available since these situations offer the best opportunity to assess spray deposit with minimal interference from trees, or other objects which might alter or obstruct the spray pattern. Meandering lines through a stand or across a spray block presents greater difficulties in establishing sampling points in relatively open areas, but has the benefit of being less obvious to the spray aircraft from the air. Cardlines located within a stand should not contain samplers located any closer than a distance of at least one tree height to the nearest tree to prevent deposit losses from the filtering or screening influences of the trees (Maksymiuk, 1963). In addition to card grids or cardlines, a random placement of 10 - 20 spray deposit cards should be located in or near the post-treatment evaluation plots, to establish a record of treatment that can later be used to help explain anomolies in post-treatment budworm densities.

The location of sampling grids or cardlines should be known only to Spray Assessment personnel. Deposit sampler locations will be drawn on the back of each Spray Deposit Assessment form. The maps will be easy to read, and at a large enough scale to include sufficient detail so that any project personnel can return to the site. Spray sampling grid or cardline maps should include obvious landmarks, North arrow, road or trail to cardline or grid, and any other helpful information.

During treatment of a spray block, Spray Assessment personnel should quickly examine all spray cards within a few minutes after spraying. Crews should report appearence of spray deposit on cards, and any obvious skips, to the Project Coordinator so that corrections can be made. Crews will wait a minimum of 1/2 hour before collecting cards from treated areas to allow time for the fine droplets to settle out. Cards will be collected and handled in such a manner as to not disturb the deposit-bearing surface. Each card will be collected in numerical sequence, and a field estimate made of the number of droplets (including fines) within the one square-centimeter box drawn on the card. The number of droplets will be recorded on the Spray Deposit Assessment Form. After estimating deposits, cards will be carefully removed from the plastic holder and inserted into a card box, keeping the cards in their numeric order. Card boxes should be covered to insure that dust and moisture does not reach the cards while being transported for further examination.

Laboratory Procedure

Counts and measurement of deposit will be conducted on a random sampling of cards drawn from each cardline or spray sampling grid. The Project Coordinator will assign which cards to count and measure based on a random selection. A minimum of 20% of the cards from each sampling grid or cardline will be counted and measured. The deposit within the one-centimeter square of each card drawn will be counted (including fines) using a handheld magnifier or under a microscope. The number of droplets counted will be entered on the Spray Deposit Assessment Form in the appropriate place. The Project Coordinator will randomly check the counts on some of the counted cards. Recounts of cards will be made if the crew member's counts differ by more than +/- 20% of the Project Coordinator.

SAFETY

SAFETY IS A PART OF EVERYONE'S JOB PERFORMANCE ON THIS PROJECT, REGARDLESS OF THEIR LEVEL IN THE ORGANIZATION.

All employees working on this project are expected to be familiar with the appropriate sections of FSH 6709.11 Health and Safety Code Handbook, and FSM 5700 Aviation Management.

The Project Coordinator is responsible for reviewing daily safety proceedures and to see that safety procedures are followed:

Some major points of the Safety Program are:

All injuries and accidents are to be reported immediately to the appropriate supervisor.

Personal protective equipment, when required, will be worn by all employees.

Hazardous conditions and other safety concerns will be reported immediately to the appropriate supervisor.

Each employee will comply with the occupational safety and health standards, rules, regulations, orders, and directives.

GOALS

Prevent accidents and protect the safety and health of all project personnel on and off the job.

Prevent property damage during the project.

Maintain project efficiency.

OBJECTIVES

The objectives of the Safety Program are to establish and maintain a positive safety atmosphere which will:

Stress the importance of a positive safety attitude and safe work practices on the part of all project personnel and recognize that all project personnel are a part of the safety program.

Prevent accidents both on and off the project.

Maintain safety standards that meet or exceed requirements.

Establish and maintain positive inspection procedures.

Maintain records of all incidents on the project.

Encourage open communications between project personnel, contractor employees, and project management staff.

PROCEDURES

Accident Prevention

Orientation and Training

All project personnel will receive orientation and training to accomplish their job.

All project personnel will participate in a pre-application orientation.

Safety briefings are a regular part of the daily activities.

Personal Protective Equipment

Supervisors are responsible for identifying hazards and insure that project personnel wear appropriate personal protective equipment when exposed.

Hazard Inspections

The Project Coordinator will inspect and monitor all project operations, and take immediate action to correct the deficiencies.

Air Operations Safety

Air operations will meet or exceed Forest Service standards.

Gallatin Dispatch (WYIFC) will be in operation whenever spray aircraft are in the air on this project.

Observation aircraft will fly at an altitude above the spray aircraft's highest turn-around altitude.

A copy of Fixed Wing Aircraft Safety Precautions will be provided to all employees working with aircraft on this project.

Vehicle Safety

Drivers are responsible for the safe maintenance and operation of their vehicle. Vehicles that are not safe to operate will be grounded.

Drivers will check their vehicles daily.

Visitor Safety

Visitors will follow the same guidelines as project personnel. Visitors to the project shall not jeopardize the safety of project personnel or the efficiency of the project.

Personal protective equipment, where required, will be worn by all personnel visiting the project.

Pesticide Labels

Bacillus thuringienses (B.t.), a biological agent, mixed with water is the only pesticide being applied.

Product Label instructions and information on the Materials Safety Data Sheet will be used for safe handling of this material.

B.t. is not designated as a hazardous material for the purpose of transportation by the Department of Transportation.

B.t. can be decontaminated using a solution of 5 percent clorine bleach. Burial or ground surface disposal is an acceptable procedure.

First-Aid

Each crew will have one individual trained in First-Aid to a minimum level of Red Cross Standard First-Aid or equivalent, and their card is current. Employees working alone will have a current First-Aid card.

Individual First-Aid kits will be provided to individuals on the project. Larger kits will be carried in vehicles and present at all airfield operations. Eye wash kits will be available to supplement the First-Aid kits.

EMERGENCY OPERATIONS

Aircraft Incident

This has the potential of becoming a Life-Threatening situation. Resolution of an Aircraft Incident will take priority over all other activities on the project.

In the event of an Overdue Aircraft, Downed Aircraft away from airfield, or Downed Aircraft on airfield, **IMMEDIATELY** notify Gallatin Dispatch at WYIFC and follow the procedures in the Northern Region Aircraft Crash, Search, and Rescue Guide (copies available at all Gallatin NF base stations). Gallatin Dispatch will **IMMEDIATELY** take over the management of any aircraft incident and assign the appropriate personnel to that incident.

If the spray aircraft is involved in the incident, the observation aircraft will be available for assistance.

If the observation aircraft is involved in the incident, the spray aircraft will be **IMMEDIATELY** recalled to the operations airfield.

[illegible] hydrogen[illegible] [illegible]. [illegible] with water is [illegible]

[illegible] and [illegible] information on [illegible]
[illegible] handling of [illegible] material.

[illegible] is not designed [illegible] material [illegible] the purpose of [illegible] by the Department of [illegible]

[illegible] can [illegible] using [illegible] solution of [illegible]
[illegible] of [illegible] disposal [illegible]

Each crew will have one individual [illegible]
[illegible] Standard [illegible]
[illegible] Employees working alone will have [illegible]

Individual [illegible] will be provided [illegible] individuals [illegible]
[illegible] larger [illegible] will [illegible] and [illegible] all
[illegible] operations. Eye [illegible] will be available [illegible]
[illegible]

[illegible]

[illegible]

This [illegible] the potential [illegible]
[illegible] will [illegible]
activities on the project.

In the event of an [illegible]
[illegible], or Downed Aircraft: [illegible]
[illegible] and follow the [illegible] in the [illegible] Region
[illegible]
[illegible] (see [illegible])
[illegible]

[illegible] in the incident, the [illegible]
[illegible]

[illegible] to the incident, the [illegible]
[illegible] the [illegible]

Medical Incident

Normal Emergency Medical Procedures will be followed. The project can continue so long as it does not interfer with the treatment and/or transportation of the sick or injuried.

An Emergency Medical Plan will be provided to all employees working on the project.

Pesticide Spill

The contractor is responsible for any "Spills" of pesticide after he has taken receipt of the pesticide material from the Forest Service. The contractor will provide the Forest Service with a "Spill Plan". This plan must meet the standards in FSH 2109.12 - Pesticide Storage, Transportation, Spills, and Disposal Handbook and appropriate State regulations. This plan will include information concerning appropriate measures to be taken by the Forest Service in the event of an aircraft incident with the contractors portion of the project.

CHECKLIST OF MATERIALS

* B.t. insecticide
* spray cards and wire holders
* spray dye

* remote weather station
* belt weather kit
* weather forecast forms (spot forecast)
* pencil/paper

* binoculars (2 pair)
* camera
* aerial photos and maps
* stop watch (to check air speed)
* calculator
* hand lens
* flashlight and batteries

* bucket/shovels
* vehicles
* road closed signs
* hand radios
* extra radio batteries
* first aid kit

* spotter plane
* contract spray plane
* flight dispatch log

[illegible] transportation [illegible] site [illegible] selected.

At the Energy [illegible] will [illegible] project.

[illegible] Drill

The contractor is responsible [illegible]
[illegible]
[illegible] will provide [illegible]
[illegible]
[illegible] to be taken by the [illegible]
[illegible]

FIXED WING AIRCRAFT SAFETY PRECAUTIONS

Pre-plan flight routes with pilot and discuss local hazards.

Plan for potential conflicting air space uses, such as military low level flight routes and high voltage powerline corridors.

Consider the very low angle of sun rays during early morning flights: avoid flying from sun into shadows if possible.

Pay attention to changes in wind direction.

Pilot will have the final say in the operation of the aircraft and the safety of flight routes.

Do not overload aircraft.

No flying during hazardous winds and poor visibility.

Observation aircraft to maintain radio communications with spray aircraft and base station, and will check-in with the base station every 15 minutes. DO NOT fly with inoperative radio equipment.

Avoid flight patterns that laterally place aircraft to close.

A qualified person must load equipment.

Do not slam, bang, or force aircraft doors: learn how to operate doors from inside and outside.

Keep seat belt and shoulder harness fastened until the pilot gives the signal to exit.

Coordinate flight paths and landing patterns of observation and spray aircraft.

Report malfunctioning aircraft.

Keep spray pilot briefed on operation plans, changes, weather forecasts, land features, elevations and other critical or sensitive elements that may affect their operation of aircraft.

Pilots must follow contract regulations and provisions.

No passengers other than those authorized by the Forest Service may be carried on flights.

Except for landings and takeoffs, no flight below 500 feet above ground level is permitted with observation aircraft.

Always know where you are, where the nearest air strip is, and the nearest terrain suitable for an emergency landing.


R. 15 E.
T. 1 N.
YELLOWSTONE
R. 16 E.
R14E
R15E
R16E
PROJECT AREA
SWEET GRASS CO.
STILLWATER CO.


Mountain
Ellis
Mountain
P.I. Gate
P.I. Gate
1713
482
2550
2552
1713C
GALLATIN
6600
6400
7000
6200